

WHAT IS CLAIMED IS:

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1. A variable geometry turbocharger assembly comprising:
 - a turbine housing having an exhaust gas inlet and an outlet, a volute connected to the inlet, and a nozzle wall adjacent the volute;
 - a turbine wheel carried within the turbine housing and attached to a shaft;
 - a plurality of vanes disposed within the turbine housing between the exhaust gas inlet and turbine wheel, each vane comprising:
 - an inner airfoil surface oriented adjacent the turbine wheel;
 - an outer airfoil surface oriented opposite the inner airfoil surface, the inner and outer airfoil surfaces defining a vane airfoil thickness;
 - a leading edge positioned along a first inner and outer airfoil surface junction;
 - a trailing edge positioned along a second inner and outer airfoil surface junction;
 - and
 - a hole disposed within a first axial vane surface substantially parallel to the nozzle wall for receiving a respective post therein, said post projecting from the nozzle wall towards the turbine wheel;
 - wherein the vane has an airfoil thickness that is greater than about 0.16 times a length of the vane as measured between the vane leading and trailing edges.
 2. The variable geometry turbocharger assembly as recited in claim 1 wherein each vane has an airfoil thickness in the range of from about 0.16 to 0.50 times the length of the vane.
 3. The variable geometry turbocharger assembly as recited in claim 1 wherein the inner airfoil surface comprises a convex surface portion and a concave surface portion moving from the vane leading edge to the vane trailing edge.
 4. The variable geometry turbocharger assembly as recited in claim 1 wherein the outer airfoil surface comprises a convex surface having a radius of curvature that is less than about 0.8 times the vane length.

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5 5. A variable geometry turbocharger assembly comprising:
a turbine housing having an exhaust gas inlet and an exhaust outlet, a volute connected
to the inlet, and a nozzle wall adjacent the volute;
a turbine wheel carried within the turbine housing and attached to a shaft;
a plurality of vanes disposed within the turbine housing between the exhaust gas inlet and
turbine wheel, each vane comprising:
an inner airfoil surface oriented adjacent the turbine wheel;
10 an outer airfoil surface oriented opposite the inner airfoil surface, the inner and
outer airfoil surfaces defining a vane airfoil thickness;
a leading edge positioned along a first inner and outer airfoil surface junction;
a trailing edge positioned along a second inner and outer airfoil surface junction;
15 a hole disposed within a first axial vane surface substantially parallel to the nozzle
wall for receiving a respective post therein, said post projecting from the nozzle wall
towards the turbine wheel; and
an actuation tab extending from a second axial vane surface opposite from the
first vane surface;
wherein the vane inner airfoil surface comprises a convex surface adjacent the leading
20 edge and a concave surface adjacent the trailing edge, and wherein the vane airfoil thickness is
in the range of about 0.16 to 0.50 times the vane length as measured between the leading and
trailing edges; and
means for engaging each vane tab and rotating the vanes in unison within the turbine
housing.

25 6. The variable geometry turbocharger assembly as recited in claim 5 wherein the
outer airfoil surface comprises a convex surface having a radius of curvature that is less than
about 0.8 times the vane length.

30 7. The variable geometry turbocharger assembly as recited in claim 6 wherein the
outer airfoil surface comprises a convex surface having a radius of curvature that is in the range
of from about 0.2 to 0.8 times the vane length.

8. A variable geometry turbocharger assembly comprising:
a turbine housing having an exhaust gas inlet and an exhaust gas outlet, a volute
connected to the inlet, and an integral outer nozzle wall adjacent the volute, the nozzle wall
comprising a plurality of posts projecting outwardly therefrom;
a turbine wheel carried within the turbine housing and attached to a shaft;
a plurality of vanes pivotably disposed within the turbine housing, each vane comprising:
an inner airfoil surface positioned adjacent the turbine wheel;
an outer airfoil surface positioned opposite the inner airfoil surface, the inner and
outer airfoil surfaces defining a vane airfoil thickness;
a leading edge provided along a first inner and outer airfoil surface junction;
a trailing edge provided along a second inner and outer airfoil surface junction,
wherein the airfoil thickness is at least about 0.16 times a length of the vane measured
between the leading and trailing edges;
a hole disposed within an axial vane surface positioned substantially parallel to
the integral outer nozzle wall, each vane hole accommodating placement of a respective
post therein for providing pivoting vane movement, each vane further comprising an
elongated actuation tab extending outwardly from an axial vane surface opposite from the
holes;
an annular unison ring disposed within the turbine housing and positioned axially
adjacent the axial vane surface of each vane providing the actuating tabs, the unison ring having
a plurality of slots to accommodate a respective vane tab therein, wherein each slot is configured
to provide nonrotating sliding movement of a respective tab therein; and
means for rotating the unison ring within the turbine housing along an axis running
through the shaft, wherein rotation of the ring causes the tabs to slide within respective slots and
cause the vanes to move radially inwardly or outwardly relative to the shaft, such radial vane
movement being facilitated by the pivoting action of each vane about a respective post.

9. The variable geometry turbocharger assembly as recited in claim 8 wherein the
inner airfoil surface has a convex surface portion adjacent the leading edge, and a concave
surface portion adjacent the trailing edge.

10. The variable geometry turbocharger assembly as recited in claim 9 wherein the outer airfoil surface comprises a convex surface having a radius of curvature that is less than about 0.8 times the vane length.

11. A vane for use in a variable geometry turbocharger, the vane comprising:
an inner airfoil surface;
an outer airfoil surface oriented opposite the inner airfoil surface, the inner and outer airfoil surfaces defining a vane airfoil thickness;
a leading edge positioned along a first inner and outer airfoil surface junction; and
a trailing edge positioned along a second inner and outer airfoil surface junction;
wherein the vane has an airfoil thickness that is greater than about 0.16 times a length of the vane as measured between the vane leading and trailing edges.

12. The vane as recited in claim 11 wherein each vane has an airfoil thickness in the range of from about 0.16 to 0.50 times the length of the vane.

13. The vane as recited in claim 11 wherein the inner airfoil surface comprises a convex surface portion and a concave surface portion moving from the vane leading edge to the vane trailing edge.

14. The vane as recited in claim 11 wherein the outer airfoil surface comprises a convex surface having a radius of curvature that is less than about 0.8 times the vane length.

15. The vane as recited in claim 11 further comprising a hole disposed within a first axial vane surface substantially parallel to the nozzle wall for receiving a respective post therein.

16. The vane as recited in claim 15 further comprising an actuation tab extending from a second axial vane surface opposite from the hole.

17. A vane for use in a variable geometry turbocharger, the vane comprising:
an inner airfoil surface;
an outer airfoil surface oriented opposite the inner airfoil surface, the inner and outer airfoil surfaces defining a vane airfoil thickness;

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5 a leading edge positioned along a first inner and outer airfoil surface junction; and
a trailing edge positioned along a second inner and outer airfoil surface junction;
a hole disposed within a first axial vane surface substantially parallel to the nozzle wall
for receiving a respective post therein;
an actuation tab extending from a second axial vane surface opposite from the hole,
wherein the vane has an airfoil thickness that is greater than about 0.16 times a length of
the vane as measured between the vane leading and trailing edges, and wherein the outer airfoil
10 surface comprises a convex surface having a radius of curvature that is less than about 0.8 times
a length of the vane.

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